Exploring Potential of Sketchnoting as a Tool for Constructing Learner´s Knowledge in Geography

Stela Csachová* [iD]
Pavol Jozef Šafárik University, SLOVAKIA

Daniela Kidonová
Pavol Jozef Šafárik University, SLOVAKIA

Abstract: In the paper, we explore the potential of sketchnoting as a tool for constructing learner´s knowledge. Sketchnoting is non-linear note-taking method that combines text and visual elements to express knowledge in a complex form, and is represented by text, symbols, arrows, frames, and other visual elements. Drawing on theory of dual coding and theory of multimedia learning, it is argued that a learner retains information more permanently if they process it verbally and visually at the same time. Sketchnoting can be effectively implemented in a learning process. We illustrate sketchnoting as a supportive learning tool by empirical study with learners at geography lessons in a secondary grammar school. We assessed twenty students´ first sketchnotes and found out most of them focused on facts rather than relations. It is therefore suggested that teachers draw more attention to organisation, structure and interrelations of the elements of knowledge in sketchnote when introducing it first to learners.

Keywords: *Dual code theory, geography, non-linear note-taking, sketchnoting.*

Introduction

Note-taking is a part of a learning process and occurs across the curriculum in many school subjects. Its practice is considered as important skill performed by learners to capture, store and memorize the knowledge (Mosleh & Baba, 2013). The major aim of note-taking is to build up a stable external memory that helps learners learn (Boch & Piolat, 2005). It is believed to have a positive impact on a learner as it helps to process information more deeply (Paepcke-Hjeltness et al., 2017). Note-taking is still commonly used in daily life, in meetings or conferences to quickly record of what is being heard (e.g., European Commission, 2019).

At school, learners take notes at various subjects. They summarise the knowledge in short sentences to create a reference for its later use. In transmissive instruction the words predominate at the lessons. The average writing speed of a learner is around 0,3 to 0,4 words/second, whereas a lecturer speaks at a rate of around 2 to 3 words/second (Boch & Piolat, 2005). Thus, in conventional note taking it is impossible for a learner to write notes verbatim linearly, since essential information and key ideas may be inundated in long sentences. It is therefore recommended that learners take notes combining text with visuals – outlining, doting, colour coding, drawing arrows to indicate connections and many others (Rohde, 2015). Note-taking, either intuitive or guided, is personal, characterized by style and methods that one has developed over time throughout their educational career (Paepcke-Hjeltness et al., 2017). Educators explore various note taking strategies and techniques to make learning more effective. According to many studies (Fernandes et al., 2018; Gansemer-Topf & Paepcke-Hjeltness, 2019; Trahorsch, 2018) sketchnoting is a technique that enhances learners´ knowledge retention. It supports the process of discovering, creating and constructing the information – the core of constructivist educational practices (Tomčíková, 2020).

In the line with it, this paper´s main goals are: (a) to examine the potential of sketchnoting as a relatively novel method of note-taking and give examples of how it can be integrated into geography subject and (b) to assess a set of learners´ sketchnotes, and give recommendations for due implementation. The motivation for this topic is that one of the authors of this paper is a dedicated practitioner of sketchnoting who tries to promote this method for educational purposes in Slovakia.

* **Corresponding author:**
Stela Csachová, Pavol Jozef Šafárik University in Košice, Slovakia. ✉ stela.csachova@upjs.sk

The term sketchnoting is defined as a technique of taking notes using visual elements and text (Rohde, 2015). The product of sketchnoting is a hand-drawn sketchnote, a coherent visual representation of content that is created by active listening to the presenter and capturing ideas using the basic elements of sketchnoting such as square, circle, triangle, fonts, colours, highlights, other expressive devices (arrows, grids, text bubbles) and combinations of these. As an example, figure 1 depicts the sketchnote on geography of Spain.

Figure 1. Sketchnote on the Topic of Geography of Spain (authors)

Sketchnoting relies on dual coding theory (Clark & Paivio, 1991), multimedia learning theory (Mayer, 2005) and the theoretical framework of concept mapping (Buzan & Buzan, 2012). According to the dual code theory (Figure 2), the human brain processes information according to the type of information received by the senses via two channels (modes) – the verbal channel processes words and the visual channel processes images respectively. The verbal and visual modes work independently, but they can communicate with each other and form associations. Provided verbal information is supported verbally and visually at the same time, it is more likely to be retained and learning efficiency will be enhanced (Trahorsch, 2018). If a teacher shares verbal explanations (or written text) and visual images simultaneously, learners process the information more easily. Adding visuals to a verbal description can make the presented ideas more concrete.
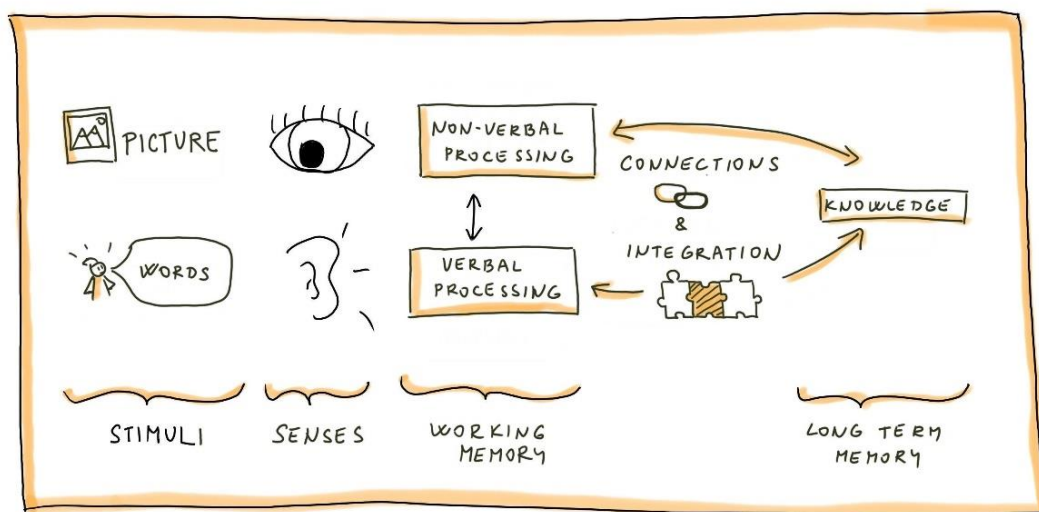

Figure 2. Dual Code Theory (Csachová & Kidonová, 2021)

The cognitive theory of multimedia learning (Mayer, 2005) builds on dual code theory and emphasizes the involvement of multiple senses at the same time for a more effective learning process. A learner is better able to recall from memory a piece of knowledge for which they can imagine. The recall of a mental image is a key factor that largely determines whether or not the information is retained (Clark & Paivio, 1991). Fernandes et al. (2018) in their research compared drawing, writing and looking at pictures in order to retain information, concluding that most participants recalled from memory those words that they drew or those to which they added decorative elements or details.

Literature Review

Sketchnoting in the learning process has been investigated by a number of researchers. Paepcke-Hjeltness et al. (2017) investigated the potential of sketchnoting with industrial engineering learners at a university. They identified the main benefits of it as engaging, enhancing their creative self-confidence and critical thinking, and retaining knowledge. This method, as opposed to textual notes, opens up new avenues for problem solving and communicating content through visuals. Sketchnoting as a tool for communicating knowledge and visualizing complex information in teaching ecology is developed by Gansemer-Topf et al. (2019), who suggest mastery of such a technique can help science learners develop the ability to identify and solve problems and make their learning more effective over a longer time. Learner perceptions´ analysis shows that over two-thirds find this tool valuable and would recommend it to other learners. Fernández-Fontecha et al. (2019) examined sketchnotes as multimodal complex based on scientific articles from physics. Sketchnoting science based on technical content is valuably addressed by Dimeo (2021), providing a deep insight into creating sketchnotes and bringing plenty of technical sketchnotes.

Bratash et al. (2020) studied sketchnoting from a psycholinguistic perspective by conducting two experiments. In the first experiment, they investigated learners' subjective opinion of sketchnoting, which showed learners found the technique interesting but time-consuming. In the second one, they used an eye movement method to find out how learners can retell the text from the written notes and from the sketchnotes they produced. The results did not show that sketchnoting was significantly more effective than traditional note-taking. Comparing the application of linear and non-linear structuring of the thematic unit to mental representation of learners through conceptual mapping can be found in Kozárová and Duchovičová (2020). They found that non-linear structuring is more appropriate strategy than linear structuring in history classes. In the experiment by Petrova et al. (2020), learners read and analysed biographies of Russian writers in four different templates (three sketchnotes and one text). The evaluation criteria were scales of informativeness, understandability, interest, readability, and structure. It was found that learners process information faster and better if it was presented in the form of sketchnotes. They considered the best template for sketchnotes to be "path" as it followed learners with information in the sequence that was delivered to them. This method in geography teaching was tested by Trahorsch (2018), who saw benefit in that learners were able to structure their own notes, integrate learning or search for relationships among concepts, with regard to the individuality of learners. Paepcke-Hjeltness et al. (2017) stress that sketchnoting activates not only divergent, holistic thinking, but also convergent, analytical thinking. It has the potential to enhance drawing confidence, designing ability, idea generation and change learning behaviour. Sketchnoting is also favourite among wide public, with pioneer piece of work of Rohde (2015). To them the method is promoted also via popular channels like books, blogs, posts and videos (e.g. Duckworth, 2019; Pillars, 2015 and more).

The future of sketchnoting is likely to lie in artificial intelligence which helps learner to transform old notes into sketchnotes in a way it scans the text based notes for key information and recommends visuals from users' existing visual library for them to transform notes into sketchnotes (Fernandez & He, 2019).

How Learners and Teachers Can Start Sketchnoting

Sketchnoting can reach learners primarily through their teachers. Teachers can learn about this technique through self-study of available literature or organized events. Pillars (2015) and Paepcke-Hjeltness et al. (2017) offer a process for integrating sketching into teaching. The first phase is teacher training. In the process of preparation for teaching, the teacher creates a visual library of symbols, icons, drawings, which can be used to visualize and communicate some information. The teacher can think in advance and prepare icons to refer to the information. The next phase is to introduce the issue to learners. The teacher can involve learners in the process of creating icons. In time, they will get used to the same and repetitive icons and will easily invent new ones in their visual library. The next phase is the application. The teacher applies the sketching technique and can implement it in several ways. Initially, teacher can draw a sketch together with the learners, so as a result these sketchnotes can be similar or almost identical. As learners gain more experience, they create their original sketches. When knowledge is completely new to learners, sketching is more demanding. After they acquire the knowledge they could invest more time to organising and structuring the information in their sketchnotes.

How to Assess Sketchnote

Whether sketchnotes can or should be assessed is a question for evaluators, and if so, what assessment criteria should be taken into account. Neill (2019) points out two reasons to assess learners´ sketchnotes. Firstly, by providing

feedback on learner's current note-taking style, teachers can point out opportunities for improvement. Secondly, with grading practices, teacher can encourage students to try out techniques they might not otherwise use. It is assumed sketchnoting is a technique that can be improved by experience. When learners repeatedly use it, teacher can make a feedback of their work and assess it.

Roßa (2019) suggests what makes difference between "good" and "bad" sketchnote. Generally stated, a sketchnote is considered good if it is visually attractive and catches reader´s attention. However, aesthetic aspect of sketchnote is only a collateral criterion. Other important aspects are functionality and practicality of the sketchnote as well as its clear structure and form. Neill (2019) claims the sketchnotes should not be compared with each other or they should not be assessed exclusively visually. What should be assessed is whether the experience with sketchnote is meaningful and whether the visual notes fulfil the aim. Sketchnotes are primarily drawn by a user for their own purposes and is highly personalised.

When a teacher introduces the learners with sketchnoting for the first time, their first sketchnote should serve to all of them and should be clear, understandable, readable for all of them. Teachers should bear in mind several criteria of „a good sketchnote" to make communication between teacher and learners effective (Roßa, 2019). The assessment criteria can refer to "appropriate and clear structure, easily readable and recognizable topic, visual hierarchy, are words of the same issue close to each other and separated from the others?, ability to see the beginning, middle and the end part of the skechnote?, readability of the text, visual attractiveness, symbols and simple pictures, use of adequate colours, shadowing, are all important concepts and terms featured in the sketchnote?"

Neill (2019) suggests to assess sketchnotes by more approaches. Quantitative approach (criterion-referenced) means that a teacher identifies terms, concepts and ideas which should be acquainted by the learners. The teacher can prepare the rubric assessment and learners know what will be assessed. Qualitative approach identifies what is correct in learners´ work and the areas where they can improve and progress. It aims to motivate so they are then likely to reuse this technique again. Self-assessment as another approach makes learner to self-reflect their own activity, to identify the strong and weak aspects and assess it adequately. Final approach is peer assessment as a collective view of the peers on the sketchnote.

It is also stressed in Sumeracki (2021) that sketchnotes are not for decorations and using images in a powerpoint slide cannot be considered a sketchnoting. Similarly, photographs do not work well for dual coding because they present too much background information.

Methodology

Research Design

In this inquiry the aim is to explore the potential of sketchnoting as a tool that can construct learners´ knowledge and in what ways it is worthwhile. Three research questions are raised:

- Is sketchnoting attractive for teachers?
- In what ways does sketchnoting have potential to enhance learning process?
- Is learner´s sketchnote ratable/evaluatable?

We use qualitative research design focused on content analysis of learners´ products. We understand the term sketchnote as a visual-textual material being created during a lesson by a learner either from the teacher´s word heard or after reading the text. Text and visuals in a particular sketchnote are interrelated and personalised, they give meaning predominantly to the author who has created it, not necessarily to all learners. Sketchnote is mostly created by hand, using pencil or pen. We also recognise electronic sketchnote created in virtual environment with a graphic tablet. Other ways of creating sketchnotes, e. g. in Microsoft office word or in powerpoint presentation programme need to be sensitively considered however they lack the traits of a real sketchnote and the act of drawing, spatial organisation, connecting the information and making it personal is reduced therein.

Sample and Data Collection

The inquiry was arranged at the time of Coronavirus disease (COVID-19) pandemic from November 2020 to May 2021 when in-school teaching was cut off in Slovakia. At the outbreak of the pandemic, teachers were encouraged to come up with new teaching practices during online learning. In November 2020, we organised a webinar on the topic of sketchnoting (not only) to geography teachers. Teachers were invited via Facebook (group of Club of Geography Teachers) and via platform of the national educational project – IT Academy. Its primary goal was to instruct the participants with basic principles of sketchnoting and to show them how to create sketchnote and integrate it into geography lessons. There were 18 teacher participants at the webinar. We showed them examples of learning activities with sketchnoting and at the end of the webinar, they were asked to provide us with their perceptions which were collected and analysed for the first research question. The reliability of these data is recognizably limited. Due to the fact that only participants interested in the topic joined this webinar, positive answers were anticipated.

After the webinar, we started cooperation with a teacher who was committed to intervene with sketchnoting at her geography lessons and shared the experience with us. She experimented sketchnoting during distant learning in February 2021. Her learners had no prior experience with it so that she introduced the method and instructed learners, deliver the subject knowledge, and get them to make their first sketchnotes which were the subject of our further analysis and source of inquiry for the second and third research questions. The teacher provided us with twenty learners´ sketchnotes.

Analyzing of Data

Our data were mostly of qualitative character. We have analysed the sketchnotes based on a set of criteria. The first criterion was grounded on face validity meaning whether the learner product is a sketchnote or not at a first sight. Another criterion was a template (structure) of knowledge learners used to organise their knowledge using the terminology of Rohde (2015). Noteworthy was how learners approached to represent the knowledge – by drawing a sketch, writing words or both. We counted the number of subject content written terms, number of drawn sketches and symbols and made a simple quantification. Last we considered the number of colours learners used. The sketchnotes were finally discerned between "real" and "quasi" ones. The content analysis was carried out by the two coders – the authors of the paper. First round of analysis was replicated by second round to sustain the reliability of data. However, our paper´s findings cannot be generalizable as they rather should be understood as results of first teacher´s intervention with new teaching method in teaching practice.

Findings

In the following part we present the results to our research questions. First question if sketchnoting is attractive to teachers, brought mostly positive utterances. The participants found it inspiring and supporting imagination. Most participants said they experienced mental mapping in their teaching practice. One participant said "...it is not for everybody, but certainly there are learners who would love to do that." Another participant added "...obviously I will try to present this technique in the best way I can, but I really cannot draw". Another participant said she had experience with concept mapping so that she welcomed the usage of this method. The obstacle can be their concern about how to judge the style of sketchnoting. Participants were asked to propose geography topics that they found suitable for making use of sketchnoting. They suggested topics of Geography of Europe, Geography of Slovakia, and physical-geographical topics as climate (air circulation, winds, clouds) or hydrosphere. Teachers who participated at the webinar generally appreciated the method, however expressed certain concern about their abilities to draw.

As to the second research question, a cooperating teacher applied this method to bilingual grammar school students (14 years-old students) at geography lessons. The lesson goal was to revise the knowledge of the regional-geographical topic of Regions of Slovakia. Teacher introduced sketchnoting to students based on materials received at the webinar. Then she got students to listen to her talk on geographical comparison of regions of Slovakia. She instructed them to choose three regions of Slovakia (one from western, one from central and one from eastern Slovakia) and compare them from the geographical perspective. They could have their geography textbooks open on that topic while making their first sketchnotes. They were allowed to take more time to complete them later.

Twenty study sketchnotes (n=20) were submitted for our consideration (Table 1). They were of different templates – photos of hand drawn sketchnotes (5) and electronic sketchnotes (in pdf or pptx formats) (15). Learners used six different templates of sketchnotes, having preferred the radial one (Figure 4), which is suitable for addressing facts and comparisons. More radials in one sketchnote was the mostly used organization of knowledge by learners in this activity. Having counted the number of terms (concepts) and number of pieces of drawings (icons, symbols) included in the sketchnotes, most (11) included from 11 up to 20 concepts and icons as well. In most of the cases (11), the concepts were written with letters and at the same time associated with drawings, so learners used dual coding as a key notion of sketchnoting. Most learners created colourful skechnotes, only quarter of them included less than two colours.

*Table 1. Assessing the Sketchnotes (*terminology by Rohde, 2015)*

Format	N	Template*	N	Terms	N	Drawings (or icons)	N	Colours	N
hand drawn	5	radial	12	less than 10	3	less than 10	4	less than two	5
electronic	15	modular	2	11 – 20	11	11 – 20	8	more than two	15
-	-	skyscraper	2	21 – 30	2	21 – 30	5	-	-
-	-	popcorn	1	31 – 40	3	31 – 40	2	-	-
-	-	vertical	2	more than 40	1	more than 40	1	-	-
-	-	linear	1	-	-	-	-	-	-

Based on the definition of sketchnote, five of them can be considered "real" hand drawn sketchnotes whereas as many as fifteen of them are "quasi" electronic sketchnotes. Figure 3 provides examples of learners´ hand drawn sketchnote and figure 4 electronic sketchnote. Why majority of students produced electronic sketchnotes can be explained by the

fact students preferred electronic learning environment during distance learning. Also, geography content knowledge (comparing the regions from the geographical perspective) was delivered to students by factual and conceptual knowledge. Learners preferred to use icons for standing alone terms with no or only few interrelationships. Learners were allowed by teacher to prepare electronic version of sketchnotes and to edit them afterwards.

Looking at the learners´ sketchnotes (Figure 3, Figure 4), both promoted the Košický kraj region as one of the self-governing regions in Slovakia. Figure 3 shows a sketchnote created by hand. The central position accounts for a map of the administrative division of the Košický kraj region into the districts and the location of the region within Slovakia. In the upper part, there are three representations of tourist attractive locations – the Vihorlat mountains, Betliar castle, and a bunch of grapes pointing at winery region of Tokaj in this part of Slovakia. In the lower part of the sketchnote there is the representation of large water dam of Zemplínska Šírava and one of the rivers in this part – the Laborec River. The higher temperature as a typical trait of this part of Slovakia is illustrated by a shining sun. The combination of textual and visual elements is clear, the number of concepts is lower, the interrelations are few, however own drawings are appreciated.
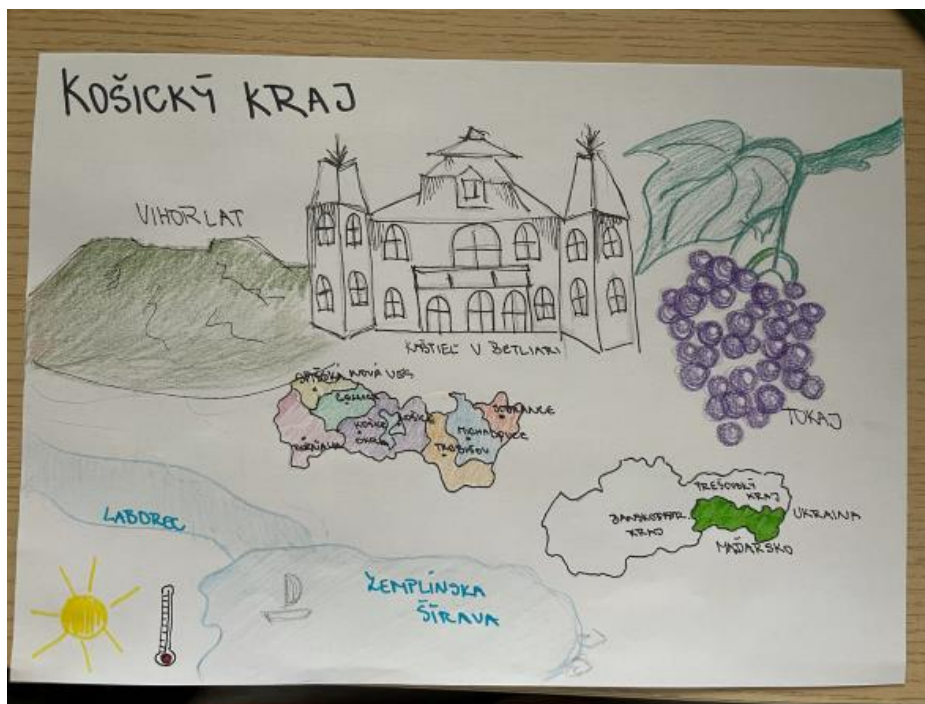

Figure 3. Example of Student Sketchnote – a Hand-Drawn Sketchnote on the Košický Kraj Self-governing Region
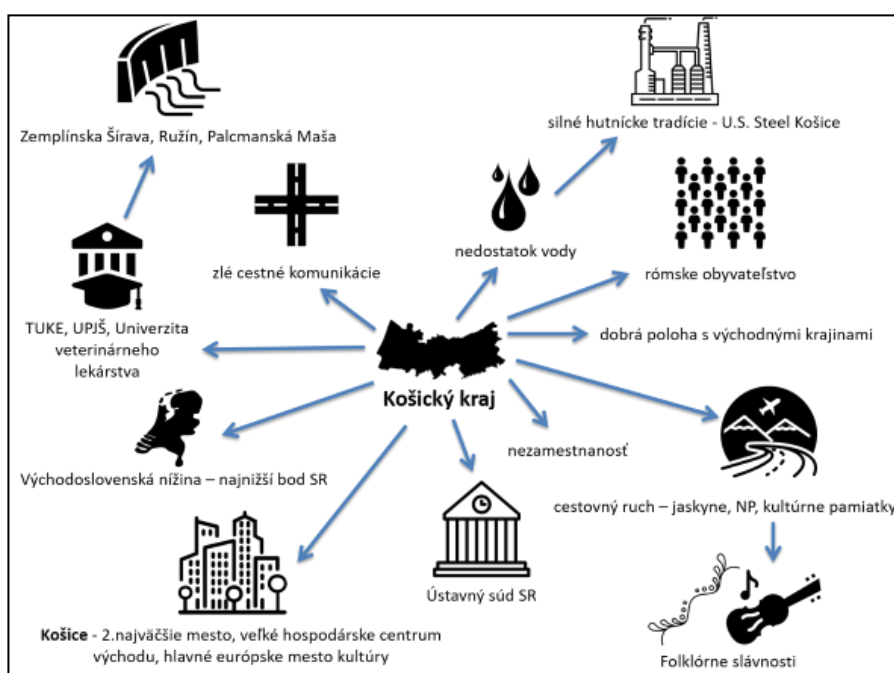

Figure 4. Example of Student Sketchnote – Electronic Sketchnote on the Košický Kraj Self-governing Region

Figure 4 provides an example of electronic sketchnote created in powerpoint presentation slide. The central position is filled with the black outline image of Košický kraj region, from which radial arrows are organised. The icons represented different facts that are characteristic in that region – steel industry (U. S. Steel Košice), tourism – caves, natural and cultural sights, city of Košice with Constitutional Court, Roma population. Learner also named socio-economic and environmental benefits and problems of that region as higher unemployment, low quality of routes, lack of underground water sources.

Discussion

Our goal was to empirically inquire the process of introducing sketchnoting to geography teachers and the transfer of it to their students. Teachers who participated at our instructional webinar appreciated the method, but at the same time expressed certain concern about their disability to draw. We started to cooperate with one teacher who was committed to try sketchnoting with her students and provided us with material to assess and found that sketchnoting, as many research studies confirmed, is beneficial for students as it supports activity, autonomy, creativity and self-confidence (Dimeo, 2021; Fernandez & He, 2019; Fernández-Fontecha et al., 2019; Gansemer-Topf et al., 2019; Heideman et al., 2017; Paepcke-Hjeltness et al., 2017; Trahorsch, 2018). The sample of twenty students´ first sketchnotes revealed that a quarter of them can be considered "real" hand drawn sketchnotes whereas three quarters are "quasi" electronic sketchnotes. Students focused on terms rather than relations between them and preferred one-colour electronic icons instead of their own drawing.

Based on the scholarly knowledge and the results of our empirical study, we attempted to consider the potential of sketchnoting for constructing the learner´s knowledge.

One of its main benefits is that it activates learners. Creating a sketchnote means that a learner needs to concentrate, listens, selects information, creates images, adds notes, and all is done simultaneously. This technique can develop learner´s creativity. Even learners receive the same information from the teacher, their notes are divergent because the way the brain processes information is unique for each learner so it permits them to think differently despite the same input information. Their creativity is demonstrated by their ideas not the art of drawing itself. Another benefit is that it promotes learner´s individuality and independence as they express thoughts in the form of their own individual record of learning and choose what to write down. Since sketchnote primarily serves to its author and it can be enigmatic to other readers. Sketchnoting is experiential, more frequent usage leads to improvement in the visualisation and faster note-taking (Trahorsch, 2018). According to Pillars (2015), sketchnotes can foster the self-confidence of those learners who have a fear of presenting to their classmates, so by focusing on their own notes they are encouraged to feel free to share their ideas. For a teacher sketchnotes can be a feedback on how the learner understands the topic. Unlike linear text, it emphasizes the hierarchy of concepts and their interrelationships, thus can provide teachers with valuable information about the mental structure of learner´s knowledge (Trahorsch, 2018). As to classroom climate, Duckworth (2019) argues sketchnoting is a calming activity.

One of the shortcomings to applying this method is time. It is useful for the first use of sketchnoting to be preceded by careful explanation and illustrations of appropriate examples. Learners find difficulty in listening, interpreting and recording visual information at the beginning. The age of the learners should also be taken into account. The method may not be suitable for children of younger school age, as learners of this age group have not yet the cognitive abilities that are necessary for finding connections, relationships and hierarchies between key concepts (Trahorsch, 2018). Novakovová (2015) states that children at the age of five years are able to create simple hierarchical concept maps, but at around ten-year children can create maps that show the quality and complexity of their thinking. Learners may not welcome this method when it is completely new to them (Gansemer-Topf et al., 2019). They may oppose that they cannot draw and may reject this technique. Conversely, learners who like to draw might more incline to this method. Also teachers´ non-identification with this method could be a barrier. Trahorsch (2018) identified many inaccuracies and considerable simplifications that can appear in their sketchnotes, which can lead to misconceptions. Therefore, he recommends that teachers regularly assess the learners' knowledge and purposefully adjust their mistakes or simplifications.

Conclusion

Writing notes is a skill that is performed by a person in various school subjects, at work and in daily life. Learners are encouraged to try new techniques that help to construct their knowledge. One of them might be sketchnoting as a non-linear note-taking method that we attempted to introduce in the paper. The notion of sketchnoting lies in creating textual and visual notes in a short period of time. Teachers who were introduced this method at webinar, encouraged this method and its use at geography lessons because they understood its potential for constructing learners´ knowledge in that it was organised, structured and better to communicate. It is more active and engaging than linear notes for present learners. Main benefits of this method are activation of learners, developing their creativity, individuality and independence and fostering their self-confidence. For a teacher the main benefit is learners´ feedbacks of the retained knowledge. In this sense it can be concluded sketchnote is an evaluatable product of a learner with a set of aspects to consider. What might hamper the usage of this method is time consumption, barriers of drawing, and non-identification of a learner and/or a teacher with this method.

Recommendations

It is advised for instructors and sketchnoters to emphasize what makes a sketchnote "real" regarding the format, organisation, structure, and stress the importance of links and interrelations during introductory sessions. It is also important to show enough examples and support that they can improve with this technique. Teachers should think over the evaluation criteria beforehand. Yet sketchnoting should be an alternative and those who do not welcome this method should obviously take notes traditionally. For researchers, the focus may be oriented to role of sketchnoting with digital technologies and artificial intelligence in the sense that hand drawing is going to be substituted by open digital library of sketchnotes that user can choose to create personalized sketchnote.

Limitations

We recognize several limitations of our research that may arouse to further investigation. A webinar to teachers as well as geography lessons with a cooperating teacher were conducted exclusively online, what restricted the contact with learners and hampered the support and guidance which was needed in the early beginning of using this technique. Motivation, application and particularly assessment might have been partly influenced by that. Due to this fact, we did not concern learners´ perceptions on sketchnoting.

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Authorship Contribution Statement

Csachová: Concept and design, data analysis, interpretation, drafting manuscript, writing. Kidonová: Data acquisition, data analysis, interpretation, critical revision of manuscript, material support.

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